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**Summary of Air Sampling at
During RCP Abandonment at
Bridgeton Landfill
May 29, 2013**

Presentation of Laboratory Analytical
Results in Comparison to Relative
Standards and Guidelines


August 27, 2013

Sign-off Sheet



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Summary of Air Sampling at Bridgeton Landfill During RCP Abandonment May 29, 2013

On behalf of Bridgeton Landfill, LLC (“Bridgeton”), Stantec Consulting Services, Inc. (“Stantec”) conducted an ambient air sampling study at Bridgeton Landfill during removal and abandonment of reinforced concrete pipes (“RCPs”). On May 29, 2013, Stantec personnel co-located samples alongside samples being collected by the Missouri Department of Natural Resources (“MDNR”) and/or representatives of MDNR. Samples of ambient air were collected in six locations, and identified as having been collected in the morning or afternoon. The six locations were: 1) On the landfill property on a hill above the flares (AM), 2) on the landfill property next to the flares (PM), 3) near the Forshaw building (AM and PM), 4) near the Virbac Animal Health building (AM), and 5) near the Northwest Auto building (PM). These locations were selected to be onsite, upwind, and downwind of the RCP abandonment activities. These air samples were analyzed for specific individual chemical constituents and analytical groupings (see Table 1, Attachment 1). The individual chemical constituents were selected for monitoring based on original work plans submitted to MDNR in August 2012 and spring 2013.

Analytical methods selected and utilized for these ambient air samples were those specified by United States Environmental Protection Agency (“USEPA”), the Occupational Safety and Health Administration (“OSHA”), the National Institute for Occupational Safety and Health (“NIOSH”), the American Society for Testing and Materials (“ASTM”), and methods developed by Columbia Analytical Services (“ALS/CAS”) specifically for odor investigations. These sampling and analytical methodologies were the same as during the previous ambient air monitoring studies and had previously been approved by MDNR.

Laboratory Analytical Results

Stantec has reviewed the laboratory analytical results for all the ambient air samples they collected onsite, upwind, and downwind of Bridgeton Landfill for potential occupational and public health significance. Sample results were compared to the USEPA industrial and residential regional screening limits (RSLs), to the OSHA PELs and to the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLVs®). The laboratory analytical results as well as relevant comparisons are presented in the following tables:

- Table 2: Ambient Air Sampling Summary for Sampling during RCP Abandonment, May 29, 2013, along with recognized regulatory and/or industrial screening guidelines or standards.
- Table 3: Polychlorinated Dibenzo-p-Dioxins (PCDD) and Polychlorinated Dibenzofurans (PCDF) Air Sampling Summary during RCP Abandonment, May 29, 2013, along with recognized regulatory and/or industrial screening guidelines or standards.

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Discussion of Results**Applicable Public Health Standards:**

When available, US EPA RSL concentrations for exposure to constituents in air in industrial and residential settings are presented on Table 2. RSLs for carcinogenic chemicals are calculated to correspond to an excess lifetime cancer risk of 1 in 1,000,000 (1 in 1 million or 1E-06) for a person (receptor) who is assumed to be exposed to that concentration on an ongoing basis over an extended period of time (25 years for industrial and 30 years for residential). RSLs for non-cancer health effects represent concentrations that are very unlikely to produce adverse health effects in people who are exposed over many years. Concentrations of constituents below applicable RSL concentrations are generally not considered to be of concern for public health. RSLs are very conservative non-enforceable risk based screening values. *Concentrations above RSLs do not necessarily mean that adverse health effects will occur, but rather indicate that additional evaluation may be appropriate.*

Applicable Occupational Standards/Guidelines:

The following occupational standards and guidelines are useful when evaluating onsite chemical compound exposures to workers at Bridgeton Landfill.

OSHA sets enforceable PELs to protect workers from adverse health effects of exposure to hazardous substances. PELs are regulatory limits on the amount or concentration of a substance to which a worker may be exposed. OSHA PELs are generally based on an 8-hour time weighted average (TWA) exposure. (<https://www.osha.gov/dsg/topics/pel/>)

ACGIH TLVs[®] are non-enforceable guidelines established to protect worker health. TLVs refer to “airborne concentrations of chemical substances, and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, over a working lifetime, without adverse health effects.” As with OSHA, these TLVs are generally 8-hour TWAs. Exposure to chemical compound concentrations at or below the level of the TLV[®] does not represent an unreasonable risk of disease or injury to workers. (<http://www.acgih.org/tlv/>).

Discussion of Results – Onsite, Upwind, and Downwind Samples

Hydrogen chloride, hydrogen cyanide, and ammonia were not detected in any upwind, downwind or onsite sample during this study. The samples collected for amine compounds were lost at some time after they were received by the laboratory. In previous studies conducted on and around Bridgeton Landfill, with few exceptions, amine compounds were undetected.

Aldehydes were detected in low concentrations in upwind, downwind, and onsite samples collected during this study. Concentrations of formaldehyde and acetaldehyde in all six samples exceeded the conservative USEPA industrial and residential RSLs, but concentrations were all well below occupational exposure limits (“OELs”). Five other aldehydes were detected in trace concentrations, well below RSLs and OELs. Also, there was one anomaly. Formaldehyde was detected in one sample in a concentration much higher than all other samples in this study and all other previous studies. Formaldehyde was detected in the upwind sample near the Forshaw building, at 120 µg/m³. Since it was

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detected in an upwind sample, formaldehyde at this concentration was not likely from the landfill or landfill activities, but more likely from a local industrial activity or diesel engine emissions.

In general, the presence of these aldehydes in upwind, downwind, and onsite samples suggest that there may be local sources of aldehydes besides the landfill, including, but not limited to combustion of fossil fuels (including diesel fuel), and wood. Formaldehyde and acetaldehyde are also commonly encountered in industrial settings. An exceedance of the RSL does not necessarily pose a public health risk, but additional evaluation may be appropriate.

Mercury was detected in one sample, upwind of the landfill activities, in the sample collected at the Forshaw building. This is the only sample in all the studies dating back to August 2012 that contained measurable mercury. The concentration exceeded the residential RSL. Detection of mercury in outside ambient air samples is not uncommon, however, since there are numerous natural and anthropogenic trace sources of mercury. The principal natural source of mercury is the natural degassing of the earth's crust (approx. 25,000 to 150,000 Tons Hg/year [WHO; Environ Health Criteria: Mercury p.43 (1976)]. Volcanoes and hot springs also contribute. Artificial (manmade or anthropogenic) sources of mercury include coal and other fossil fuel combustion, smelting of Hg-containing ores, mercury purifying operations, cement manufacturing, and breakage of mercury-containing glassware, switches, and batteries. The sample containing mercury was collected upwind of the landfill activities and suggests the source may be a local source other than the landfill.

Three (3) **carboxylic acid compounds** were detected at minimal concentrations in the onsite samples. Carboxylic acids were not detected in any downwind or upwind sample. There are no published occupational guidelines or standards or USEPA RSLs for the detected compounds. Based on the fact that carboxylic acids were detected at low concentrations and only at the onsite sampling locations, carboxylic acids are not expected to pose a risk to public health nor do they represent an occupational exposure concern.

Sulfur dioxide was detected in two samples, both downwind of the landfill, but was not detected on the landfill suggesting an alternate source. Concentrations were minimal. There are no RSLs for sulfur dioxide and the concentrations detected are well below occupational exposure limits.

Volatile organic compounds (VOCs) were detected in onsite, upwind, and downwind samples. More individual organic compounds were detected in the onsite (near flare) samples than the offsite upwind or downwind samples. Approximately forty-five compounds were detected in onsite samples and between seventeen and twenty-one were detected in either upwind or downwind samples. Concentrations of individual VOCs were generally greater for the onsite samples compared to downwind or upwind samples. However, no compounds were detected in any onsite, upwind, or downwind samples in concentrations exceeding OSHA PELs or ACGIH TLVs.

Benzene, ethylbenzene, and trimethylbenzenes (1,3,5- and 1,2,4- isomers) were detected in both sets of onsite samples, and benzene was detected in the downwind samples. None of these compounds were detected in the upwind samples. Concentrations of ethylbenzene and trimethylbenzene onsite were below industrial RSLs and well below OSHA PELs and ACGIH TLVs. The afternoon sample collected onsite also contained trimethylbenzene in a concentration exceeding the industrial RSL, but below OSHA PELs and ACGIH TLVs. All benzene sample concentrations exceeded the industrial RSL, but were below the OSHA PELs and ACGIH TLVs.. These three compounds are components of gasoline

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and gasoline combustion emissions and are fairly ubiquitous in areas with significant automobile traffic. An exceedance of the RSL does not necessarily pose a public health risk, but additional evaluation may be appropriate.

1,4-dioxane and 1,4-dichlorobenzene were also detected in the onsite samples. 1,4-dioxane was detected in the afternoon onsite sample in a concentration exceeding the residential RSL, but about ½ of the industrial RSL and well below the occupational exposure limits. 1,4-dioxane has a number of industrial applications including as a solvent stabilizer, paint and varnishes, textiles, paper and pulp industry, as a solvent/ degreaser, and in cosmetics. It does not occur naturally. The trace concentration, less than 1 µg/m³, is very low and is not expected to contribute to adverse health risk.

1,4-dichlorobenzene was detected in the afternoon onsite sample at a concentration of 4.2 µg/m³, which exceeds the residential and industrial RSLs, but is well below the OELs. 1,4-dichlorobenzene is principally an insecticide/fungicide material, and is also chemical intermediate for dyes and other products. It is occasionally used as a deodorant. It has no natural sources. The minimal concentration detected, 4.2 µg/m³, is very low and is not expected to contribute to adverse health risk.

Furan was detected at low concentrations, 4.5 µg/m³ and 12 µg/m³, in the onsite samples. It should be noted that furan is a VOC and unrelated both in structure and toxicological properties from polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF), which are discussed below. While there are no published residential or industrial RSLs for furan, the AIHA WEEL recommends that “exposure to furan be minimized to the fullest extent possible.” (AIHA, The AIHA 2010 ERPG and WEEL Handbook, AIHA, Fairfax, VA, 2010).

The National Advisory Committee (NAC) for Acute Exposure Guidelines Levels (AEGL) for Hazardous Substances provides guidance for approximately 200 compounds, including furan. An AEGL-2 is the airborne concentration of a substance below which it is predicted that the general population, including susceptible individuals, would not be expected to experience irreversible or other serious, long-lasting adverse health effects, or an impaired ability to escape. The AEGL-2 for furan is 2,400 µg/m³ for an exposure lasting 8 hours. All the measured furan concentrations are well below this value.

The **reduced sulfur compound**, Dimethyl sulfide was detected in one onsite sample at 34 µg/m³. There are no industrial RSLs for dimethyl sulfide. The concentration detected is well below the ACGIH TLV.

Polynuclear aromatic hydrocarbons were detected in onsite, upwind, and downwind samples. None of the detected PAHs were present in concentrations exceeding applicable RSLs, OSHA PELs, or ACGIH TLVs. Benzo(a)pyrene and other combustion-related carcinogenic PAHs were not detected in any sample. The detected PAH concentrations do not pose a risk to public health nor do they represent an occupational exposure concern.

Polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) were detected in all onsite, upwind and downwind samples. None of the detected PCDDs or PCDFs were present in concentrations (2,3,7,8-TCDD Toxicity Equivalents) exceeding residential RSLs. The observed concentrations of PCDDs and PCDFs do not pose a risk to public health or the environment.



ATTACHMENT 1

Summary Tables of Laboratory Analytical Results

**Table 1. Summary of Sampling Activities
During RCP Abandonment at Bridgeton Landfill
May 29, 2013**

Compound/Analytical Group	Laboratory Analytical Method	All samples collected May 29, 2013					
		Onsite		Upwind	Downwind		
		Hill above flares	Proximate to flares	Proximate to Forshaw Building	Virbac Animal Health Bldg	Northwest Auto Bldg	
Low Flow Samples							
Hydrogen Chloride	NIOSH 7903	AM	PM	AM	PM	AM	PM
Aldehydes	EPA TO-11a	AM	PM	AM	PM	AM	PM
Hydrogen Cyanide	NIOSH 6010	AM	PM	AM	PM	AM	PM
Amines	ALS 101	AM	PM	AM	PM	AM	PM
Mercury	NIOSH 6009	AM	PM	AM	PM	AM	PM
Ammonia	OSHA ID-188	AM	PM	AM	PM	AM	PM
Carboxylic Acids	ALS 102	AM	PM	AM	PM	AM	PM
Sulfur Dioxide	OSHA ID-200	AM	PM	AM	PM	AM	PM
SUMMA Canister Samples							
Fixed Gases	EPA 3Cm	AM	PM	AM	PM	AM	PM
Volatile Organic Cmpnds	EPA TO-15 + TICs	AM	PM	AM	PM	AM	PM
Reduced Sulfur Compounds	ASTM D5504	AM	PM	AM	PM	AM	PM
High Volume Samples							
PAH	EPA TO13	24 hr	NS ¹	24 hr	NS	24 hr	NS
Dioxins/Furans	EPA TO 9	24 hr	NS	24 hr	NS	24 hr	NS
1. NS = Not Sampled							

**Table 2: Ambient Air Sampling Summary
During RCP Abandonment at Bridgeton Landfill
May 29, 2013
Concentration in Ambient Air – All Units µg/m³**

Analyte	Screening Levels				Sample Locations					
	Ind. RSL ¹	Res. RSL ²	OSHA PEL ³	ACGIH TLV ⁴	Hill Above Flares	Proximate to Flares	Proximate to Forshaw Building	Proximate to Forshaw Building	Virbac Animal Health	Northwest Auto
					On-site		Upwind		Downwind	
					5/29/2013 A.M.	5/29/2013 P.M.	5/29/2013 A.M.	5/29/2013 P.M.	5/29/2013 A.M.	5/29/2013 P.M.
Hydrogen Chloride – NIOSH 7903										
Hydrogen Chloride	8.80E+00	2.10E+00	7.00E+03	3.00E+03	-- ⁵	--	--	--	--	--
Aldehydes/Carbonyl Compounds – Method: EPA TO-11a										
Formaldehyde	9.40E-01	1.90E-01	9.21E+02	3.68E+02	4.3 ^{7,8}	4.2	120	17	3.9	4.7
Acetaldehyde	5.60E+00	1.10E+00	3.31E+04	4.50E+04	2.5	5.4	1.1	1.1	1.4	2
Propionaldehyde	3.50E+00	8.30E-01	NA ⁶	4.75E+04	0.45	0.98	--	--	--	0.38
Butyraldehyde	NA	NA	7.37E+3 AIHA WEEL ⁹		0.59	1.2	--	--	0.32	0.41
Benzaldehyde	NA	NA	8.70E+03 WEEL		0.36	0.5	--	--	--	--
n-Hexaldehyde	NA	NA	NA	NA	0.47	0.71	0.37	0.68	0.39	0.79
2,5-Dimethylbenzaldehyde	NA	NA	NA	NA	3.3	6.4	--	--	0.74	0.9
Hydrogen Cyanide – Method: NIOSH 6010										
No compounds detected	3.50E+00	8.30E-01	1.10E+03	NA	--	--	--	--	--	--
Amine Compounds – Method: NIOSH 2010m										
No compounds detected	NA	NA	NA	NA	Lab Error ¹⁰	Lab Error	Lab Error	Lab Error	Lab Error	Lab Error
Mercury – Method: NIOSH 6009										
Mercury	1.30E+00	3.10E-01	1.00E+02	2.50E+01	--	--	--	0.5	--	--
Ammonia – Method: OSHA ID 188										
No compounds detected	4.40E+02	1.00E+02	3.50E+04	1.74E+4	--	NS ¹¹	--	--	--	--
Carboxylic Acid Compounds – Method: CAS AQL 102										
Propionic Acid (Propanoic)	NA	NA	NA	NA	2.6	3.1	--	--	--	--
Butanoic Acid (Butyric)	NA	NA	NA	NA	4.6	8.8	--	--	--	--
Hexanoic Acid (Caproic)	NA	NA	NA	NA	--	2.9	--	--	--	--
Sulfur Dioxide – Method: OSHA ID 200										
Sulfur Dioxide	NA	NA	1.31E+04	6.6E+02	--	--	--	--	19	9.6
Volatile Organic Compounds (VOCs) – Method: EPA TO15 + TICs										
Propene	1.30E+04	3.10E+03	NA	8.61E+05	3.9	5.8	0.67	0.98	1.7	2
Dichlorodifluoromethane (CFC 12)	4.40E+02	1.00E+02	4.95E+06	4.21E+04	1.8	1.8	2	1.9	1.8	1.8
Ethanol	1.40E+05	3.20E+04	1.89E+06	1.88E+06	21	54	--	--	8.9	8

**Table 2: Ambient Air Sampling Summary
During RCP Abandonment at Bridgeton Landfill
May 29, 2013
Concentration in Ambient Air – All Units µg/m³**

Analyte	Screening Levels				Sample Locations					
	Ind. RSL ¹	Res. RSL ²	OSHA PEL ³	ACGIH TLV ⁴	Hill Above Flares	Proximate to Flares	Proximate to Forshaw Building	Proximate to Forshaw Building	Virbac Animal Health	Northwest Auto
					On-site		Upwind		Downwind	
					5/29/2013 A.M.	5/29/2013 P.M.	5/29/2013 A.M.	5/29/2013 P.M.	5/29/2013 A.M.	5/29/2013 P.M.
Volatile Organic Compounds (VOCs) – Method: EPA TO15 + TICs (Cont.)										
Acetonitrile	2.60E+02	6.30E+01	6.72E+04	3.36E+04	--	1.4	4.2	3.4	3.1	--
Acetone	1.40E+05	3.20E+04	2.38E+06	1.19E+06	24	39	7.8	--	13	13
Trichlorofluoromethane	3.10E+02	7.30E+01	5.62E+06	5.62E+06	1.1	0.96	0.96	1	1.1	0.93
2-Propanol (Isopropyl Alcohol)	3.10E+03	7.30E+02	9.80E+5	4.90E+5	--	6.4	--	--	--	--
Methylene Chloride	1.20E+03	9.60E+01	8.68E+04	1.74E+05	1.3	--	0.99	--	--	--
2-Butanone (MEK)	2.20E+04	5.20E+03	5.90E+05	5.90E+05	13	24	--	1.2	--	--
Ethyl Acetate	NA	NA	1.44E+06	1.44E+06	2.2	2.6	--	--	--	--
Tetrahydrofuran (THF)	8.80E+03	2.10E+03	5.90E+05	1.47E+05	6.8	13	--	--	2.3	1.5
Benzene	1.60E+00	3.10E-01	3.19E+03	1.60E+03	8.6	16	--	--	3.1	2.6
1,4-Dioxane	1.60E+00	3.20E-01	3.60E+05	7.20E+04	--	0.81	--	--	--	--
4-Methyl-2-pentanone	NA	NA	NA	NA	--	1.1	--	--	--	--
Toluene	2.20E+04	5.20E+03	7.54E+05	7.54E+04	2.9	4	0.67	0.98	1.2	1.5
2-Hexanone	1.3E+01	3.1E+00	4.10E+05	2.05E+05	--	0.77	--	--	--	--
n-Butyl Acetate	NA	NA	7.13E+05	7.10E+05	2.4	3.7	--	--	1.0	0.76
Ethylbenzene	4.90E+00	9.70E-01	4.34E+05	8.68E+04	1.1	2.4	--	--	--	--
m,p-Xylenes	4.40E+02	1.00E+02	4.34E+05	4.34E+05	2.4	5.3	1.8	2.2	--	1.3
o-Xylene	4.40E+02	1.00E+02	4.34E+05	4.34E+05	0.91	2.1	0.65	0.77	--	--
n-Nonane	8.80E+02	2.10E+02	1.05E+06	1.05E+06	--	1.3	--	--	--	--
alpha-Pinene	NA	NA	5.57E+05	1.11E+05	1.2	1.9	--	--	--	--
4-Ethyltoluene	NA	NA	NA	NA	--	0.85	--	--	--	--
1,3,5-Trimethylbenzene	NA	NA	NA	1.23E+05	--	1.3	--	--	--	--
1,2,4-Trimethylbenzene	3.10E+00	7.3E-01	1.2E+05	1.23E+05 ¹²	0.96	4.9	--	--	--	--
1,4-Dichlorobenzene	1.1E+00	2.2E-01	4.50E+05	6.0E+04	--	4.2	--	--	--	--
d-Limonene	NA	NA	1.67E+5 AIHA WEEL		2.1	11	--	--	0.9	--
Naphthalene	3.60E-01	7.20E-02	5.24E+04	5.24E+04	--	1.2	--	--	--	--
Volatile Organic Compounds (VOCs) – Tentatively Identified Compounds - Method: EPA TO15 + TICs¹³										
Isobutane	NA	NA	1.90E+03 NIOSH		3.3	--	--	--	--	--
Furan ¹⁴	NA	NA	Lowest feasible, WEEL		4.5	12	--	--	--	--
Isoprene	NA	NA	5.57E+3 WEEL		--	--	--	2.9	--	--

**Table 2: Ambient Air Sampling Summary
During RCP Abandonment at Bridgeton Landfill
May 29, 2013
Concentration in Ambient Air – All Units $\mu\text{g}/\text{m}^3$**

Analyte	Screening Levels				Sample Locations					
	Ind. RSL ¹	Res. RSL ²	OSHA PEL ³	ACGIH TLV ⁴	Hill Above Flares	Proximate to Flares	Proximate to Forshaw Building	Proximate to Forshaw Building	Virbac Animal Health	Northwest Auto
					On-site		Upwind		Downwind	
					5/29/2013 A.M.	5/29/2013 P.M.	5/29/2013 A.M.	5/29/2013 P.M.	5/29/2013 A.M.	5/29/2013 P.M.
Volatile Organic Compounds (VOCs) – Tentatively Identified Compounds - Method: EPA TO15 + TICs¹³										
Dimethyl Sulfide	NA	NA	NA	2.54E+04	5.1	18	--	--	--	--
Methyl Acetate	NA	NA	6.10E+5	6.10E+05	7.2	21	--	--	2.9	2.9
1-Propanol	NA	NA	5.00E+05	2.50E+05	--	8	--	--	--	--
2-Butanol	NA	NA	4.55E+05	3.03E+05	4.1	8.2	--	--	--	2.9
2-Methylfuran	NA	NA	NA	NA	3.5	11	--	--	--	--
1-Butanol	NA	NA	3.00E+05	6.00+04	10	34	--	--	3.5	--
n-Hexanal	NA	NA	NA	NA	--	--	--	5.3	3.2	--
Methyl Butyrate	NA	NA	NA	NA	7.3	25	--	--	--	2.7
Hexamethylcyclotrisiloxane	NA	NA	NA	NA	--	--	11	--	--	--
Unidentified Compound	NA	NA	NA	NA	--	--	9.9	--	--	--
2-Ethyl-1-hexanol	NA	NA	NA	NA	6.6	--	--	--	7.7	3.8
2-Methylcyclopentanone	NA	NA	NA	NA	--	5.6	--	--	--	--
Methyl Hexanoate	NA	NA	NA	NA	--	5.8	--	--	--	--
2-Ethylcyclopentanone	NA	NA	NA	NA	--	5.6	--	--	--	--
Butyl Butanoate	NA	NA	NA	NA	--	7.2	--	--	--	--
p-Isopropyltoluene	NA	NA	NA	NA	4	20	--	--	--	--
n-Nonanal	NA	NA	NA	NA	10	11	6.1	9.9	16	3.3
Unidentified Siloxane	NA	NA	NA	NA	--	--	4.2	--	--	--
2-Ethylhexylacetate	NA	NA	NA	NA	--	--	--	--	3.6	--
n-Decanal	NA	NA	NA	NA	--	--	7.9	--	3.4	--
n-Undecane	NA	NA	NA	NA	--	16	--	--	--	--
Reduced Sulfur Compound – ASTM D5504										
Dimethyl Sulfide	NA	NA	NA	2.54E+04	--	34	--	--	--	--
Polynuclear Aromatic Hydrocarbons - Method: EPA TO13a Modified										
Naphthalene	3.60E-01	7.20E-02	5.24E+04	5.24E+04	0.069	NS	0.059	NS	0.034	NS
Acenaphthene	NA	NA	NA	NA	0.012	NS	0.0086	NS	0.012	NS
Fluorene	NA	NA	NA	NA	0.013	NS	0.0083	NS	0.011	NS
Phenanthrene	NA	NA	2.00E+02	2.00E+02	0.032	NS	0.028	NS	0.025	NS

**Table 2: Ambient Air Sampling Summary
During RCP Abandonment at Bridgeton Landfill
May 29, 2013
Concentration in Ambient Air – All Units $\mu\text{g}/\text{m}^3$**

Analyte	Screening Levels				Sample Locations					
	Ind. RSL ¹	Res. RSL ²	OSHA PEL ³	ACGIH TLV ⁴	Hill Above Flares	Proximate to Flares	Proximate to Forshaw Building	Proximate to Forshaw Building	Virbac Animal Health	Northwest Auto
					On-site		Upwind		Downwind	
					5/29/2013 A.M.	5/29/2013 P.M.	5/29/2013 A.M.	5/29/2013 P.M.	5/29/2013 A.M.	5/29/2013 P.M.
Polynuclear Aromatic Hydrocarbons - Method: EPA TO13a Modified (Cont.)										
Fluoranthene	NA	NA	2.00E+02	2.00E+02	0.0057	NS	0.0077	NS	0.0067	NS
Pyrene	NA	NA	2.00E+02	2.00E+02	0.0026	NS	0.0033	NS	0.0027	NS
Polychlorinated Dibenzo-p-Dioxins (PCDD) and Polychlorinated Dibenzofurans (PCDF)– EPA Method TO-9A										
2,3,7,8-TCDD	3.20E-07	6.40E-08	2.0E-04 (Leung HW) ¹⁵	3.20E-07	9.99E-09	NS	3.54E-08	NS	2.16E-08	NS

1. United States Environmental Protection Agency Regional Screening Levels for Industrial Air
2. United States Environmental Protection Agency Regional Screening Levels for Residential Air
3. Occupational Safety & Health Administration (OSHA) Permissible Exposure Limit
4. American Conference of Governmental Industrial Hygienists- Threshold Limit Value
5. “—” = Compound not detected
6. “NA” = Not Available
7. ***Bold and Italic*** indicates that the found concentration exceeds the United States Environmental Protection Agency Regional Screening Level for Industrial Air (Onsite samples only).
8. ***Shading*** indicates that the found concentration exceeds the United States Environmental Protection Agency Regional Screening Level for Residential Air.
9. Available American Industrial Hygiene Association Workplace Environmental Exposure Level
10. The analysis for the two amine compounds listed above was not performed due to the samples being lost after receipt at ALS Cincinnati.
11. “NS” = Not Sampled
12. The TLV for both trimethylbenzene compounds are for “mixed isomers”
13. Tentatively Identified Compounds – under Method: EPA TO15 + TICs. The reported concentrations for TICs are estimated.
14. Furan exceeded the AIHA WEEL, which recommends that exposure to Furan be minimized to the fullest extent possible.
15. Leung HW et al; Am Ind Hyg Assoc J 49 (9): 466-74 (1988)

**Table 3: Polychlorinated Dibenzo-p-Dioxins (PCDD) and Polychlorinated Dibenzofurans (PCDF) Air Sampling Summary
During RCP Abandonment at Bridgeton Landfill
May 29, 2013^{1,2}**

Name	TEF ³	Between FR & Forshaw Warehouse - Upwind				Virbac Animal Health - Downwind				Hill Above Flares – On-Site			
		Mass	TEQ ⁴	Air volume	Concentration ⁵	Mass	TEQ	Air volume	Concentration	Mass	TEQ	Air volume	Concentration
Units	--	pg ⁶	pg	Liters	ug/m ³	pg	pg	Liters	ug/m ³	pg	pg	Liters	ug/m ³
2,3,7,8-TCDD	1	ND ⁷	--	354,240	--	ND	--	367,200	--	ND	--	364,320	--
1,2,3,7,8-PeCDD	1	6.20	6.20	354,240	1.75E-08	4.12	4.120	367,200	1.12E-08	2.67	2.670	364,320	7.33E-09
1,2,3,4,7,8-HxCDD	0.1	3.72	0.372	354,240	1.05E-09	2.25	0.225	367,200	6.13E-10	ND	--	364,320	--
1,2,3,6,7,8-HxCDD	0.1	7.96	0.796	354,240	2.25E-09	4.73	0.473	367,200	1.29E-09	ND	--	364,320	--
1,2,3,7,8,9-HxCDD	0.1	5.55	0.555	354,240	1.57E-09	3.65	0.365	367,200	9.94E-10	ND	--	364,320	--
1,2,3,4,6,7,8-HpCDD	0.01	64.2	0.642	354,240	1.81E-09	20.9	0.209	367,200	5.69E-10	14.1	0.141	364,320	3.87E-10
OCDD	0.0003	1020	0.306	354,240	8.64E-10	133	0.040	367,200	1.09E-10	152	0.046	364,320	1.25E-10
2,3,7,8-TCDF	0.1	4.27	0.427	354,240	1.21E-09	5.07	0.507	367,200	1.38E-09	ND	--	364,320	--
1,2,3,7,8-PeCDF	0.03	4.85	0.146	354,240	4.11E-10	3.86	0.116	367,200	3.15E-10	3.10	0.093	364,320	2.55E-10
2,3,4,7,8-PeCDF	0.3	3.47	1.04	354,240	2.94E-09	2.18	0.654	367,200	1.78E-09	ND	--	364,320	--
1,2,3,4,7,8-HxCDF	0.1	3.90	0.390	354,240	1.10E-09	3.73	0.373	367,200	1.02E-09	1.70	0.170	364,320	4.67E-10
1,2,3,6,7,8-HxCDF	0.1	6.32	0.632	354,240	1.78E-09	4.06	0.406	367,200	1.11E-09	3.04	0.304	364,320	8.34E-10
1,2,3,7,8,9-HxCDF	0.1	2.90	0.290	354,240	8.19E-10	1.32	0.132	367,200	3.59E-10	ND	--	364,320	--
2,3,4,6,7,8-HxCDF	0.1	4.60	0.460	354,240	1.30E-09	2.01	0.201	367,200	5.47E-10	1.29	0.129	364,320	3.54E-10
1,2,3,4,6,7,8-HpCDF	0.01	22.7	0.227	354,240	6.41E-10	10.2	0.102	367,200	2.78E-10	8.39	0.084	364,320	2.30E-10
1,2,3,4,7,8,9-HpCDF	0.01	3.58	0.0358	354,240	1.01E-10	ND	--	367,200	--	ND	--	364,320	--
OCDF	0.0003	41.6	0.0125	354,240	3.52E-11	13.9	0.004	367,200	1.14E-11	8.81	0.003	364,320	7.25E-12
Total TCDD TEQ⁸			12.53		3.54E-08		7.93		2.16E-08		3.64		9.99E-09
USEPA Industrial RSL⁹					3.20E-07				3.20E-07				3.20E-07
USEPA Residential RSL¹⁰					6.40E-08				6.40E-08				6.40E-08

1. Sampling was conducted between 11:00 A.M. May 22 to 11:00 A.M. May 23, 2013
2. Analytical Method: EPA TO-9a
3. TEF: 2005 World Health Organization (WHO) Toxicity Equivalence Factor
4. TEQ: TCDD Toxicity Equivalent Mass/Concentration
5. Concentration calculation: ((TEQ * Air Volume) * 1,000)/1,000,000
6. pg: Picograms
7. ND: Not Detected
8. Total TCDD TEQ: Total Tetrachlorodibenzodioxin TEQ
9. RSL: Regional Screening Level for Dioxins in Industrial Air
10. RSL Regional Screening Level for Dioxin in Residential Air